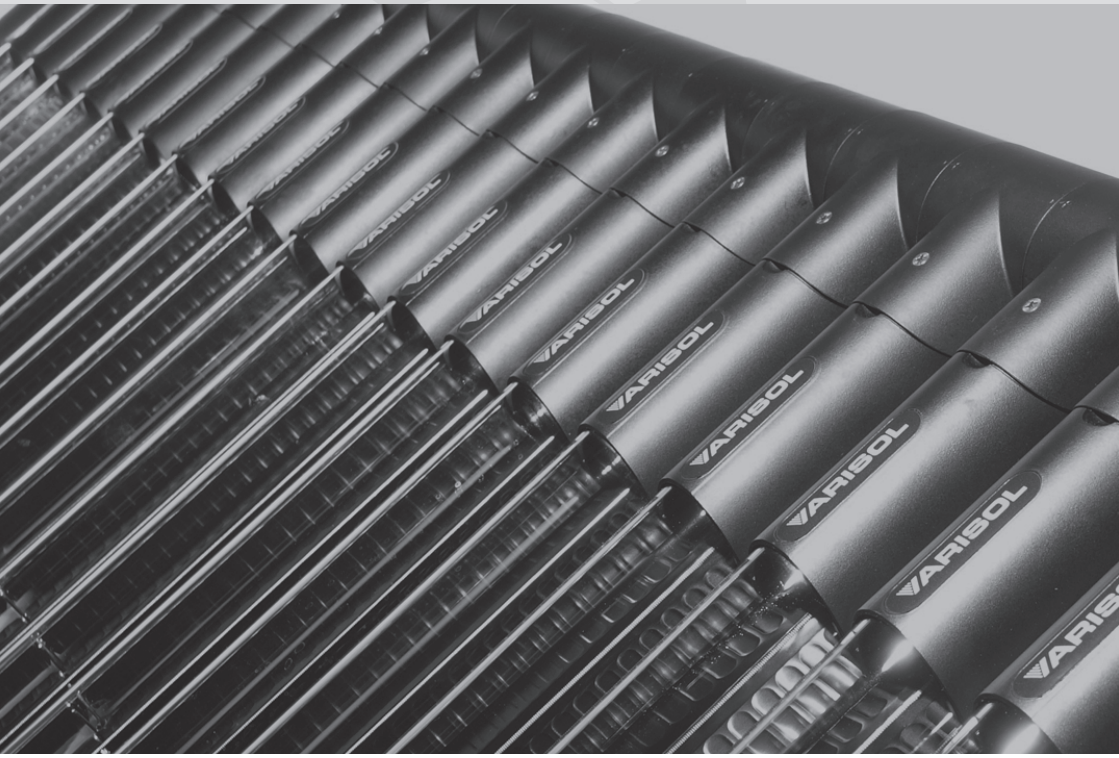
Renewables

VARISOL

Installation Manual



Kingspan®

SOLAR

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Introduction

Solar hot water systems should be designed and sized correctly before commencing the installation. Proper design will ensure that a system is correctly sized to provide many years of optimised performance and most or all of the required hot water when the most solar radiation is available. However a supplementary heating system such as oil or gas boiler, heat pump or wood boiler is required for months which have less solar radiation.

For large systems, Kingspan provide a system design service to its Accredited Installer Network and technical design consultants. Please visit www.kingspansolar.com to locate an Accredited Installer or distributor in your area.

This guide will illustrate and explain how a system should be installed to conform with the Kingspan Renewables manufacturer guidelines for the Varisol Collector.

Using this guide

Stages of a solar installation are described in the following pages, with illustrations where necessary to explain how to install the relevant components, and contains general recommendations and important safety information.

Handling Guidance

- Tube boxes should be transported horizontally.
- Heavy goods should not be loaded on top of the kit boxes.
- Care should be taken when opening boxes to prevent scratches or sudden shocks to the glass.
- Do not use sharp objects to open the tube boxes.

Installation Guidance

- Unpack and install tubes only after the roof-kit and pipe work has been installed.
- Do not leave the solar collector exposed to solar radiation when the solar loop and collector have been drained. Collectors left exposed in a dry state must be covered to prevent possible long term damage.
- The dark blue side of the copper within the tube is the active surface.
- A heat dissipation loop (heat dump) is recommended
- The pipework of the solar collector loop is to be earthed and the collector is to be lightning protected in accordance to local regulations.

For further technical support please contact the following numbers,
Ireland - 1800 812 718 or UK – 0845 812 0007.

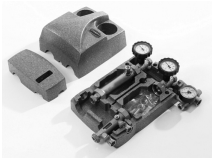
Health and Safety Precautions

A solar panel installation must be performed in accordance with all Health & Safety legislation and local building/planning regulations for the relevant jurisdiction.

Furthermore, the necessary electrical work required to install control equipment should be undertaken by a qualified electrical contractor.

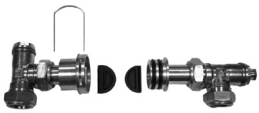
02

Standard Kit Components


Dual Stream Pump Station

SC100 Controller

Sloping Roof Kit
with Brackets


Connection Kit

Flexi Connections

Expansion Vessel

Tubes

Cooling Vessel
(DF100 only)

Tyfocor® LS

Additional Components

Solar Roof Flashing

Installation tool

22mm Thermostatic Mixing Valve
Note - 28mm also available

Insulated Hose
Mounting Set

22mm 3 Port Diverter Valve
Note - 15 & 28mm also available

Stubfitting

Important Pre Installation Information

Sizing of safety equipment

Expansion vessel sizes are relative to the volume of liquid in the system. Therefore it is important that the Thermomax 'Technical Design Guide' is consulted for each system.

Pipe Sizing (minimum of 15mm diameter pipework must be used)

Varisol Pressure Drop - Tyfocor LS			
Collector Area m^2	Flow Rate Ltr/hr	Pipe External Diameter mm	Pressure Drop mbar
1	60	15	2
2	120	15	3.5
3	180	15	10
4	240	15	21
5	300	22	35*
6	360	22	53
7	420	22	80*
8	480	22	110*
9	540	22	153

* figures marked as such are estimates based on other measurements

Varisol Collector Expansion Vessel Sizing				
Collector Area m^2	System Volume Ltr	Static Height m	Expansion Vessel Size Ltr	Cooling Vessel Size Ltr
1	18.9	5	18	5
2	20.8	5	18	5
3	22.7	5	25	8
4	24.6	5	25	8
5	26.5	5	35	12
6	28.4	5	35	12
7	30.3	5	35	12
8	32.2	5	50	18
9	34.1	5	50	18

When selecting a vessel for intermediate sizes, the vessel should be selected by rounding area up to nearest m^2. All sizes above are calculated based on a 17ltr system volume as an example. For larger volumes the expansion vessel size should be recalculated. Cooling vessel sizes are dependant on pipe dimensions and can be calculated on a case by case basis or selected using the table above as a guideline.

Cooling Vessel Sizing

It is strongly recommended that a cooling vessel is used with the collector to protect the expansion vessel from stagnation temperatures.

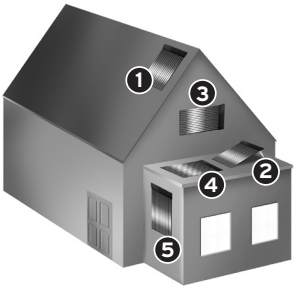
04

Roof Kits

Standard Roof Fixings

The Varisol product range is available with a choice of roof fixing options to suit many roof types, see diagram below for the most common fixings. Roof fixings are available for slate, tiled, double lap plain clay, metal seam and concrete. For others please contact Kingspan. The most common fixings are illustrated and explained in the following section and may be easily secured to slate, tile or masonry finishes.

Roof kits and their relevant manufacturer codes:



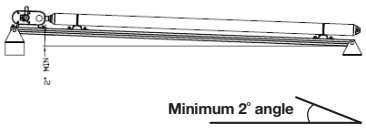
Option	Code	Description
1	KSK0039	Varisol 10 Sloping Roof Kit
	KSK0040	Varisol 20 Sloping Roof Kit
	KSK0041	Varisol 30 Sloping Roof Kit
	KSK0062	Varisol 10 Bolt Down Roof Kit
	KSK0063	Varisol 20 Bolt Down Roof Kit
	KSK0064	Varisol 30 Bolt Down Roof Kit
2	KSK0042	Varisol 10 A Frame Kit
	KSK0043	Varisol 20 A Frame Kit
	KSK0044	Varisol 30 A Frame Kit
3, 4 and 5	KSK0065	Varisol 10 Façade Kit
	KSK0066	Varisol 20 Façade Kit
	KSK0067	Varisol 30 Façade Kit

Horizontal Installations

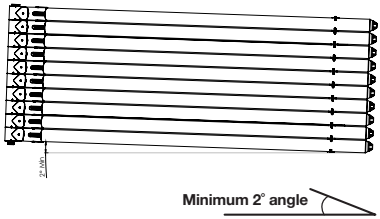
With any installation where the collector is installed horizontally on a wall façade or roof surface; the airvent on the collector manifold must be the highest point of the collector, otherwise air in the system will remain in the pipes within the collector tubes and be difficult to flush out. Airlocks in the pipes will stop circulation through the system.

When the collector is orientated correctly, i.e. with the manifold slightly higher than the base of the collector, (see below) air will be forced back into the system. In this instance the air separator will prevent air from circulating.

Flat horizontal orientation
(option 4 above)



Wall horizontal installation
(option 5 above)



Roof Kit Sizing

The modular design of the Varisol collector means that any number of tubes can be assembled to make up the required collector size. Since the mounting kit cross rails are only supplied in 10, 20 and 30 tube sizes it is necessary to cut the rails to length should an intermediate sized collector be required. The table below gives the required length of rail for each given size. Burrs and sharp edges should be removed.

Collector Area m^2	Number of tubes	Required Cross Rail Length mm	Side Rail Separation mm
0.1	1	71	
0.2	2	142	
0.3	3	214	
0.4	4	285	
0.5	5	356	
0.6	6	427	
0.7	7	498	
0.8	8	569	350-450
0.9	9	640	350-550
1	10	712	500-600
1.1	11	783	500-600
1.2	12	854	500-600
1.3	13	926	500-700
1.4	14	997	500-700
1.5	15	1068	600-800
1.6	16	1139	600-900
1.7	17	1210	600-900
1.8	18	1281	600-1000
1.9	19	1352	600-1000
2	20	1423	600-1100
2.1	21	1494	700-1200
2.2	22	1565	700-1200
2.3	23	1637	700-1200
2.4	24	1708	700-1200
2.5	25	1779	700-1200
2.6	26	1850	800-1300
2.7	27	1921	800-1300
2.8	**28**	**1992**	**800-1400**
2.9	**29**	**2063**	**800-1400**
3	**30**	**2135**	**800-1400**

Examples:

- To make an 18 tube collector simply take a 20-way rail and cut to 1281mm.
- To make a 44 tube collector join a standard 20-way rail to a 24-way, the 24-way being made by cutting a 30-way rail to 1708mm.
- In the case of a sloping roof mounted collector, the available rafter spacing should be considered when sizing the collector to ensure that an appropriate side rail spacing can be achieved.

Collector Assembly - Sloping Roof

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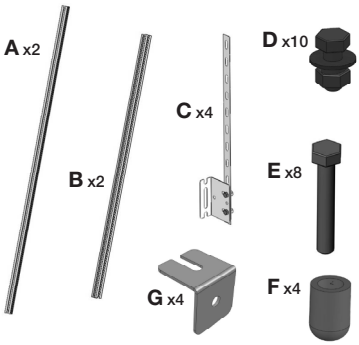
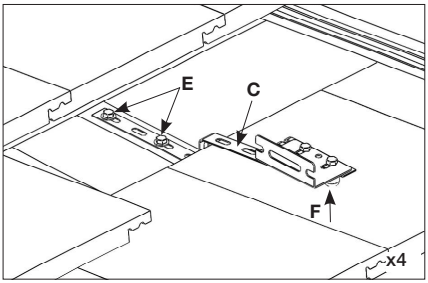
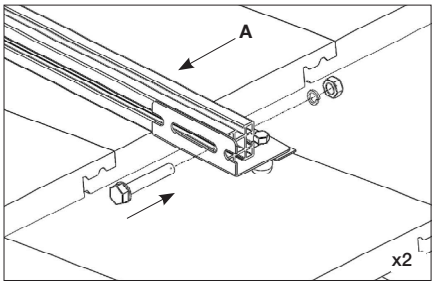
Fixing the rails



Step One

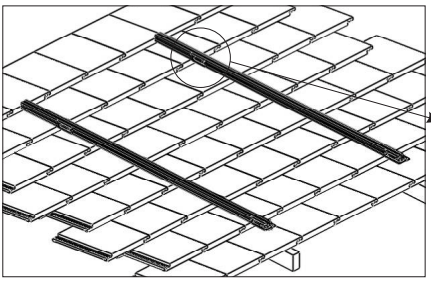
1. Refer to mounting kit sizing on page 5 for bracket seperation
2. Attach brackets (C) to roof using M8x50 coachscrews (E)
3. Secure side rails (A) to lower brackets using M10x65 bolt assy

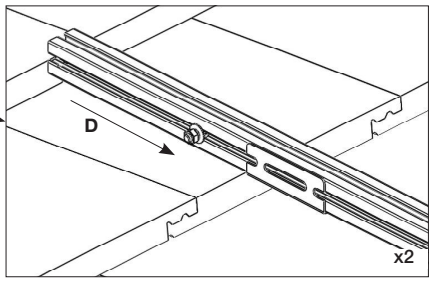




Step Two

1. From upper end of each side rail, slide 2 M8x16 bolt into position
2. Secure side rails (A) to upper brackets (C) using M8x20 bolt assy

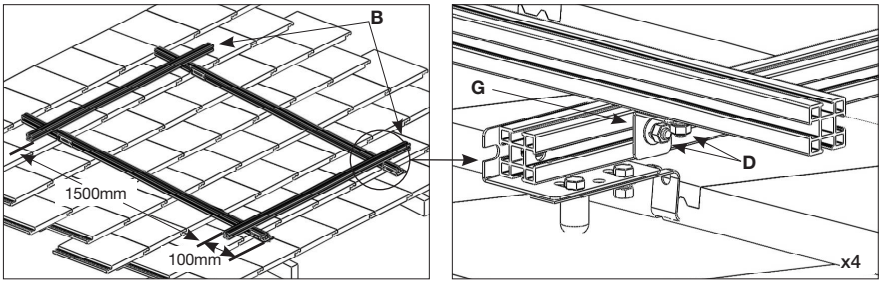




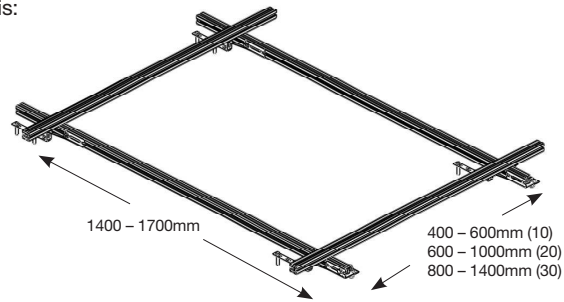
Attaching Support Rails

Step Three

1. Refer to mounting kit sizing on page 5 for support lengths
2. Slide 2 M8 bolts into lower face of each support rail (B)
3. Attach support clamp (C) in 4 places using M8 nuts & washers at locations illustrated
4. Lower support rail onto support clamps (G)
5. Secure support rail to clamp using M8 nuts and washers (D)



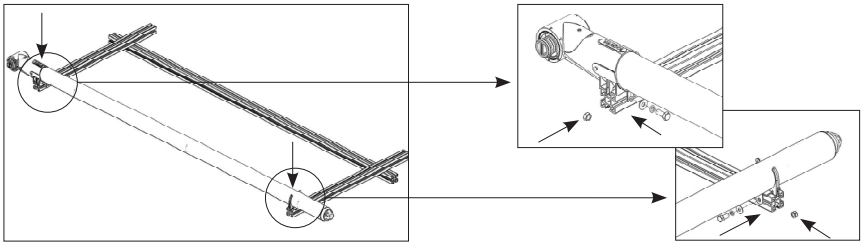
It should look like this:



Inserting the first tube

Step Four

1. Slide 2 M8 nuts into front face of each support rail extrusion
2. Align first tube with end of support rail and push home by clicking into rail (push on upper push point only)
3. Insert bolt and tighten nut
4. Align lower tube support clip into rail and push home by clicking into rail (push on lower push point only)



Connecting additional tubes

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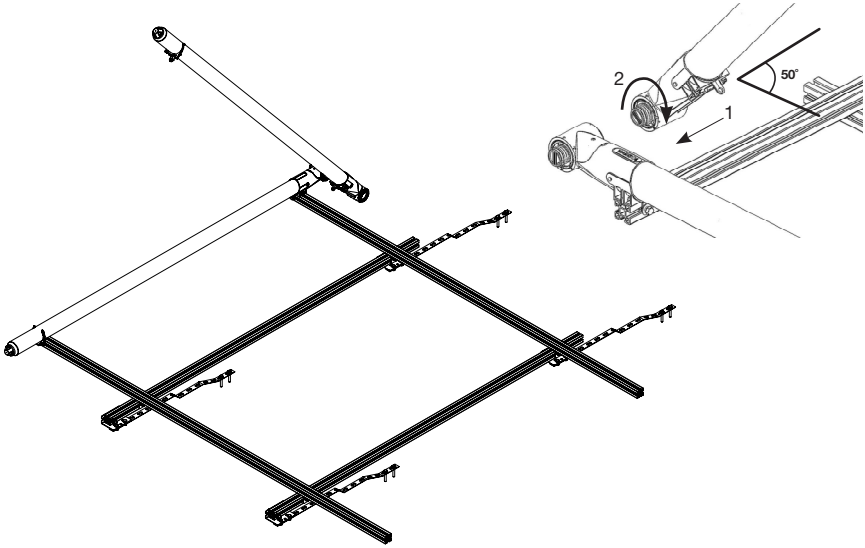
Step Five

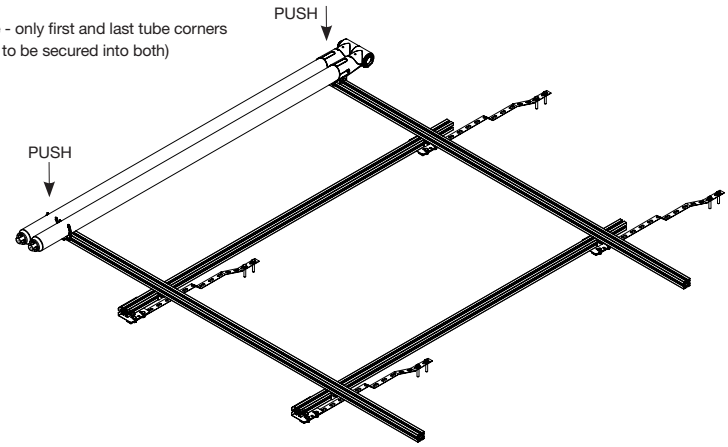
1. Rotate second tube approximately 50° to first tube, using arrow symbols on plastic enclosure for guidance
2. Firmly insert male fitting of second tube to female connection of first tube



Step Six

1. Rotate second tube parallel with first tube
2. Locate upper plastic enclosure and lower tube support clip in rail
3. Push home the upper and lower fittings into the support rail

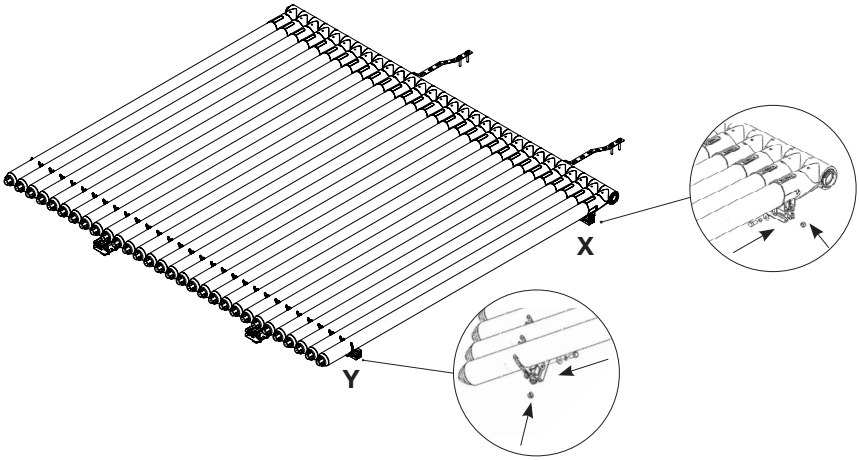
(Note - only first and last tube corners need to be secured into both)



Attaching the Connection Kit

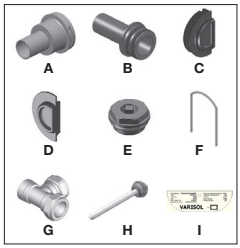
Step Seven

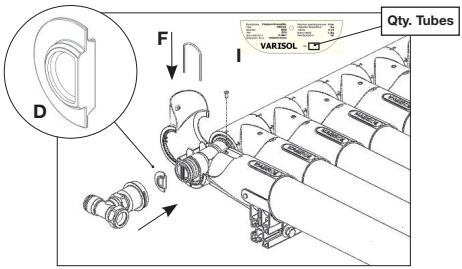
1. Continue with remaining tubes.
2. Use M8 bolt, washers and nut to lock final tube in place at **X** and **Y**

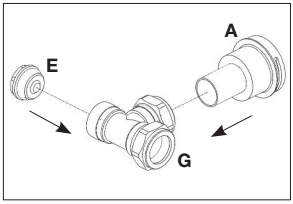


Step Eight (return connection)

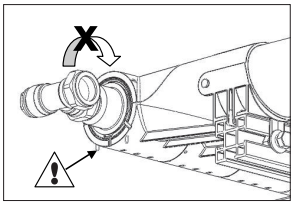
1. Place rubber seal (D) on male end of collector area (blocking upper chamber)
2. Open lid on left hand end tube fitting
3. Complete and attach technical label (I)
4. Assemble and connect end fittings (A,G,E)
5. Secure in position with clip (F)



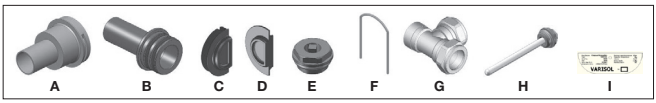




6. ⚠ Ensure clip (F) legs protrude out of bottom of enclosure
7. Close lid and secure with screw



Connecting additional tubes



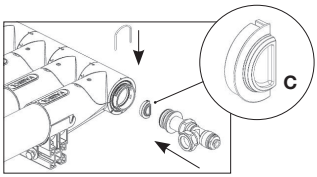
Step Nine (flow connection)

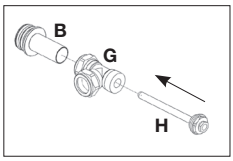
1. Place rubber seal (C) in female end of collector area (blocking lower chamber)

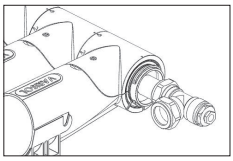
2. Remove securing pin from female end of collector

3. Assemble and connect end fittings (B,G,H)

4. Secure in position by relocating securing pin







Connection Information

In any solar panel system, the 'return' refers to the intake in the collector where liquid is returning to be reheated. The 'flow' refers to the collector side where the liquid is flowing to the heat exchanger.

Note: It is essential that the collector temperature sensor is located in the flow of the collector.

The following illustrations shows the connections to the manifold.

Types of Connections

The only pipes which should be used with a solar installation are copper pipe, continuous flexible stainless steel or mild steel.

When using copper pipe, only compression or brazed joints can be used. Solder and galvanised fittings will not withstand high temperature or expansion and are therefore not suitable for solar pipe work.

PEX / PLASTIC / PEX-ALU-PEX or GALVANISED TUBING OR FITTINGS SHOULD **NOT** BE USED UNDER ANY CIRCUMSTANCES

Flexible Pipe Connections

Flexible pipe connections are recommended to connect the manifold through the building fabric and allow flexibility in connecting to the internal pipe work.

Flexible stainless steel pipes are available in both a 15mm and 22mm diameter. If connecting one diameter pipe to another, a suitable reducer compression fitting is recommended to make the connection.

Insulation

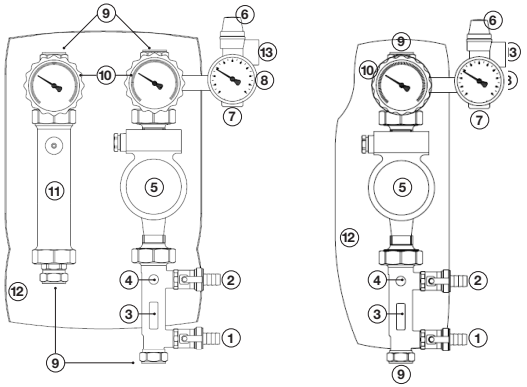
All pipe work on the solar loop should be insulated with high temperature insulation (such as HT/Armaflex from Armacell GmbH). High temperature insulation is essential as standard pipe insulation will melt at temperatures experienced by solar pipes.

The wall thickness of the insulation should be equal to the diameter of the pipe. The only pipes which should not be insulated are the pipes to the safety vessels as they should allow heat to dissipate when the system is experiencing excessive heat and pressure.

Pump Station

The Kingspan Solar Thermomax product range offers both a single stream and a dual stream pump station. Each pump station is available in two flow rates, 2-12 litres/minute and 8-28 litres/minute.

The flow rate required on a system is typically 1 litre per minute, per square metre installed. Therefore a 2-12 litre/minute pump station will be sufficient for systems up to 12m^2.



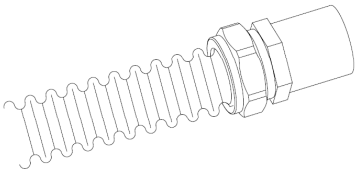
Key

1 Drain connection
2 Fill connection
3 Flow meter
4 Isolating valve
5 Motorised pump
6 6 bar pressure relief valve
7 Expansion vessel connection
8 Pressure guage
9 22mm connections (x 4)
10 Temperature guage
11 Air separator
12 Insulated fascia
13 Pressure relief discharge point

Connections of flow and return pipe work to the pump station are made with the straight compression fittings provided for direct copper connection.

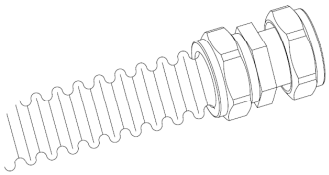
C0784 – Insulated Hose Stub Fitting

When flexible stainless steel pipe is being used to connect to the pump station, the insulated hose stub fitting is required to make the connection. The split ring within the fitting should be removed and placed over the second rib of the flexible pipe. When the compression fitting is tightened, the split ring will click twice as it positions itself and locks inside the fitting.



C0785 – Insulated Hose Clamp Ring

When the short flexible connection is being joined to stainless steel pipe work, the insulated hose clamp ring is required to make the connection. The split ring within the fitting should be removed and placed over the second rib of the flexible pipe. When the compression fitting is tightened, the split ring will click twice as it positions itself and locks inside the fitting.



Safety Vessel Connections

Pressure Relief Valve (PRV)
Rated at 6 bar, the PRV may discharge heat transfer fluid (Tyfocor® LS) which must be channelled into a container capable of withstanding high temperature discharge and containing the total collector volume. The container should be secured so it cannot be removed or spilled.

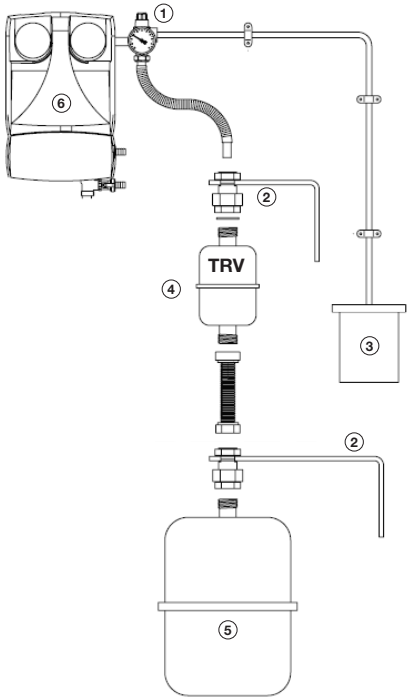
The PRV should not be channelled into a drain or any pipe work which will allow it to enter the normal water course.

Fitting the expansion vessel:
The expansion vessel must be located below the level of the connection from the pump station.

The expansion vessel supplied includes an appropriate corrugated hose and threaded connection to join the vessel to the pump station.

Temperature Reducing Vessel (TRV)
Also known as a 'cooling vessel' or 'stratification vessel', the TRV is highly recommended. Due to high temperatures which can be experienced within the solar loop, the TRV reduces the temperature of the heat transfer fluid before it enters the expansion vessel and extends the lifetime of the expansion vessel.

Fitting the TRV:
With the direct flow vessel kit, which includes the TRV, a corrugated hose assembly is included to join the expansion vessel to the TRV from the pump station.



1	PRV discharge point
2	Wall bracket (supplied)
3	Discharge container
4	TRV kit
5	Expansion vessel
6	Dual stream pump station

Wiring the Solar Control Panel

All electrical aspects of the installation should be undertaken by a qualified electrician. Note that for safety, the pump and sensor connections should always be wired prior to connecting power to the solar control panel.

IMPORTANT: The solar control panel must have a permanent electrical power supply which must not be interrupted either manually or with a time switch. If the permanent electrical supply to the building is to be switched off for any period of time, the solar collector(s) should either be covered, or the system drained and the tubes removed.

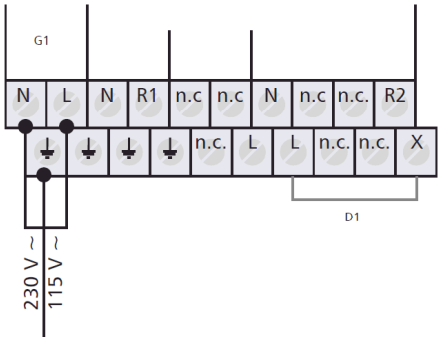
In order to protect the normal operation of the control panel, it should be located at least 100 mm from insulated pipes which may become hot during operation.

Control panels use PT1000 sensors containing twin core copper cable with a 0.75mm cross section. The sensors supplied are 1.5 metres in length.

Sensor cables can be extended with twin core copper cable of 0.75mm diameter up to 50 metres and 1.50mm diameter between 50-100m. Screened cable should be used on the sensor cables to prevent RFI from electrical cables. All connections to extend the cables should be housed in a junction box for protection.

The following diagrams show the connection of the solar pump and other relays on the SC range of controllers. This should be read in conjunction with the Installation and Operation Manual supplied with each SC control panel.

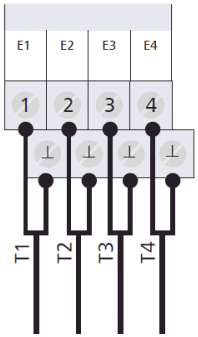
Power Supply Connection:



Sensor Connection

The connection of PT1000 sensors is as shown below. The polarity of the sensor cables is not relevant on each sensor. The SC100 has four inputs as illustrated below. However the SC200 and SC300 can receive five and six sensors respectively (for larger system design) and are connected in the same way.

Input connection for 1-4 sensors:



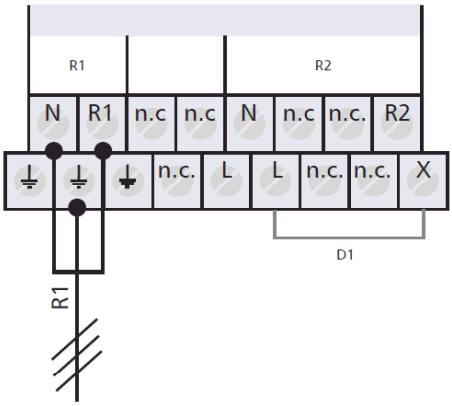
Connection of first output/pump (R1)

R1 of the SC controllers comprises a semiconductor relay (TRIAC), also suitable for RPM control with a maximum switching current displayed on the unit type plate. Both the SC100 and the SC200 contain an electromechanical relay, R2.

Note that the SC300 contains two RPM relays, R1 and R2 as well as an electromechanical relay, R3. The SC200 and SC300 are therefore suitable for controlling two pumps i.e. for an east/west panel array or a stagnation configuration requiring a second pump.

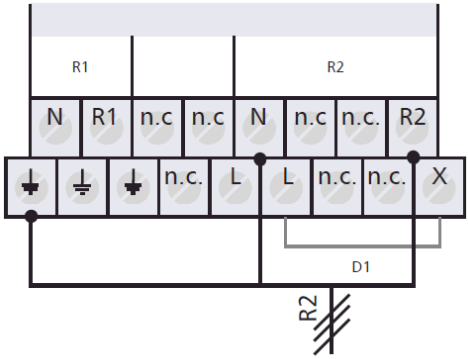
Caution

Avoiding damage and malfunctions – When connecting an external relay or contactor, or when connecting a pump which has its own electronic RPM control, the controller output's RPM control must be deactivated (see "Setting the RPM control parameters" in the Controller Manual).



Connection of second output (R2) if required

R2 on the SC100 contains a switched output via an electromechanical relay with a maximum switching current displayed on the unit type plate. Note the wire bridge (D1) must be connected.



Commissioning the System

The evacuated tubes should be installed at a time when there is very low light such as late afternoon when the sun is low and not particularly strong. Alternatively the tubes should be covered. This is important as tube connections can heat up considerably in a short space of time and have potential to cause injury even if the glass temperature remains cool.

Expansion Vessel

IMPORTANT: Prior to filling the system, the expansion vessel pressure must be set 0.3 Bar below the system pressure. Omitting to perform this check will result in irregular pressure readings during the commissioning of the system.

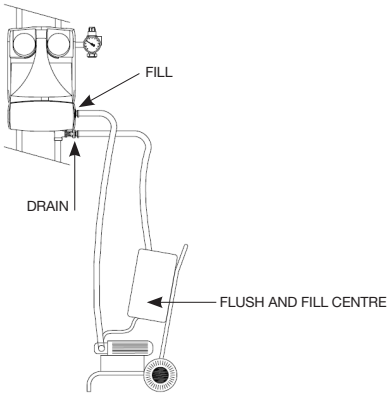
The pressure is checked at the base of the vessel and the bleed valve may be bled or topped up with a pump.

Filling the Loop

It is important that a motorised flush and fill centre is used to fill and pressurise the system with Tyfocor® LS as follows:

1. Open the fill and drain valves to allow the liquid to circulate around the solar loop
2. Turn the hot and cold temperature gauges 45° clockwise.
3. Close the isolating valve above the flow meter to ensure all air and liquid passes through the fill centre to filter any air and contaminants.
4. Run the fill centre pump to circulate the Tyfocor® LS for approximately 20 minutes.
5. Open and close the isolating valve intermittently to circulate air bubbles which may accumulate in the sight glass.
6. Return isolating valve to closed position.
7. When the solar loop has been purged of air, close the bottom/drain connection – the fill centre will begin to pressurise the solar loop
8. Reopen the isolating valve above the flow meter fully.
9. Fill the loop until the pressure gauge just exceeds the required pressure and stop the pump and immediately close the fill connection. Check pipe joints on the solar loop for leaks and check that pressure is not lost over a 30 minute period.
10. If all the plumbing is sound, set the system pressure by opening the return connection until the required pressure is met.
11. Return the temperature gauges to the original position.
12. The fill centre may now be disconnected.
13. Cap the fill and drain points with the brass covers provided.

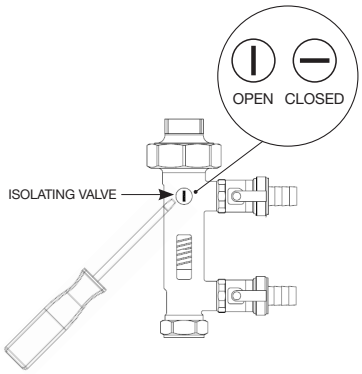
The pipes from the flush and fill centre should be connected as shown in the diagram:



Setting the flow rate

The pump may only be run when the system has been filled as dry operation will damage the pump. The desired flow rate is 1 litre per minute per m^2 (10 tubes=1m^2).

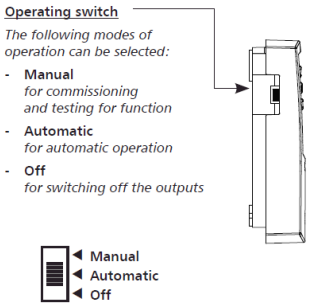
1. Set the pump to the first speed and run it manually from the controller (see following paragraph).
2. If the desired flow rate is exceeded, set the flow meter to the desired rate by adjusting the isolating valve with a flat headed screwdriver (see diagram) with the pump running. Otherwise repeat this step at the next pump speed and continue until the desired flow rate is achieved
3. Stop the pump.



Operating the pump in 'Manual' mode (for SC range controllers)

In order to run the pump in 'Manual' mode, slide the operating switch on the left side of the solar control panel to the upper of the three positions. On the screen, select the appropriate relay with the up/down arrows and press the 'Set' button to run the relay and to switch it off again.

Left side view of controller



Other Relays

If any additional relays are set up on the system, these should be tested in 'Manual' mode as above, to ensure the connections have been wired correctly.

Decommissioning the System

Due to temperatures potentially exceeding 170˚C and pressures greater than 6 bar, a solar installation should only be decommissioned by a trained individual. The system should be decommissioned in low light, ideally in the morning when the solar loop should be coolest.

1. Electrical
- Isolate controller from mains
- Remove cables to consumer units i.e. controller and pump
- Remove sensors and associated cables
- Remove earthing cables

2. Collector Loop
- Beware of hot transfer fluid
- Drain collector loop at drain valve. Contain the heat transfer fluid for appropriate disposal.
- Disconnect pipes from the manifold

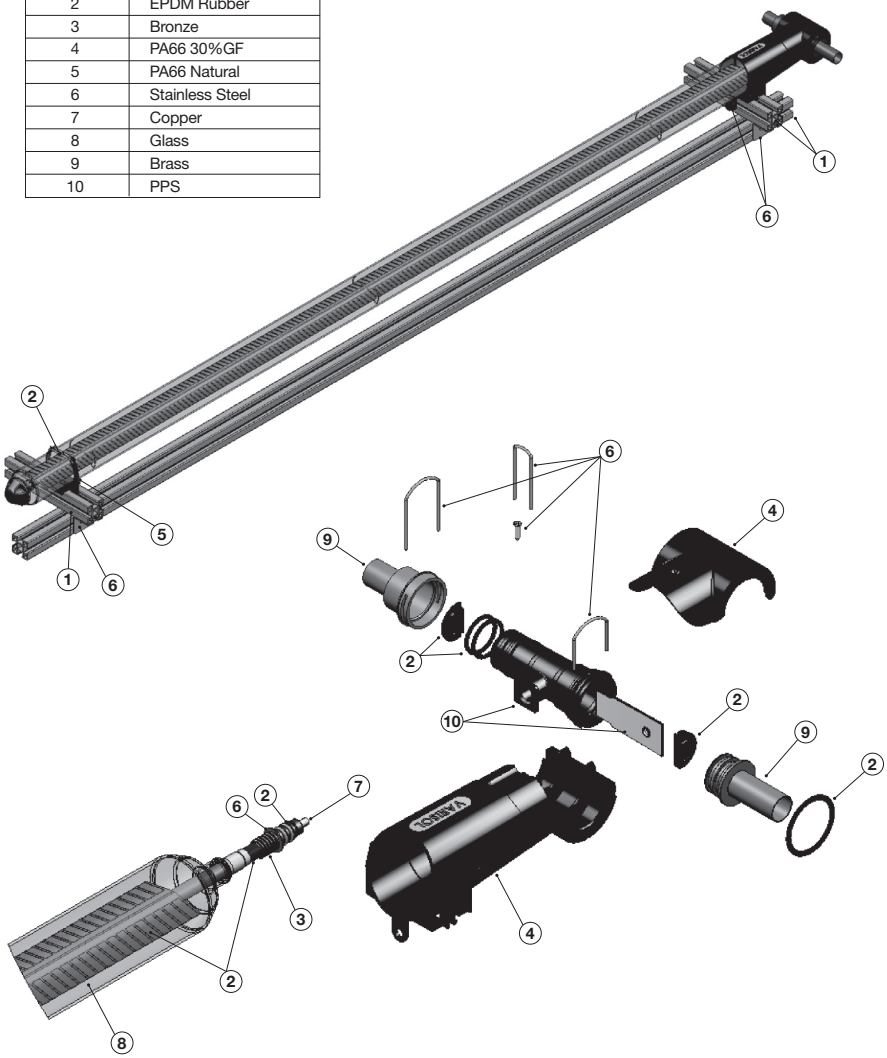
3. Varisol Collector Disassembly
- Remove M8 bolt from manifold support rail on the right hand end of the rail.
- Unclip rubber retainer on the tube support
- Slide the Varisol removal slide along the manifold support rail strating at the right hand end.
- Rotate each tube individually through 50˚ until engagement arrows line up and pull one tube from the rest of the assembly. Ensure tube is supported; only apply force onto the manifold to disengage.
- Repeat process until all tubes are removed.

Disposal

Dispose of separate materials in accordance with local regulations. Please see the following pages for details of materials used in the construction of Thermomax collectors and guidance on disposal of antifreeze.

Recycling Information

Item No.	Material
1	Aluminium
2	EPDM Rubber
3	Bronze
4	PA66 30%GF
5	PA66 Natural
6	Stainless Steel
7	Copper
8	Glass
9	Brass
10	PPS



Servicing and Maintenance

Users should regularly check the temperatures which the solar control panel is recording. With the SC range of controllers, simply pressing the 'SET' button on the fascia once will display the upper and lower collector temperatures since the control panel was last reset. If the collector temperatures have been excessively high i.e. over 170˚C, it is recommended that the antifreeze level be checked using a refractometer by a qualified engineer.

A sample of the Tyfocor® LS antifreeze fluid can be extracted from the pump station at the pump itself. The large centre of the pump hub can be opened with a large flathead screwdriver. This should be opened slowly until a few drops of the antifreeze fluid are released. A sample of the fluid placed on the glass of the refractometer will display the level of antifreeze in the system. If the antifreeze has lost its antifreeze properties the system should be refilled with fresh Tyfocor® LS.

It is recommended that the solar system is serviced annually by a qualified engineer and immediately if the system shows evidence of having lost pressure or has discharged liquid at the pressure relief valve. The Tyfocor® LS antifreeze fluid should always be replaced after 7 years.

Maintenance schedule

A qualified person should service the system at the recommended intervals, using the maintenance schedule below. In addition the user should check the system pressure at regular intervals. A visual inspection of the pressure gauge is required to check that the system pressure is maintained at the level noted below.

The service engineer should complete the following; the shaded boxes should be completed if the system requires refilling:

	Upon commissioning	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Date of inspection								
Expansion vessel setting before filling								
System pressure								
Expansion vessel setting after filling								
Flow rate								
Antifreeze level								
pH reading								
Inspection of barium getter on tubes								

Engineer details								
Print name								
Sign								
Telephone No.								

Technical Information

Wind Loading

Stress and maximum load on the substance on flat roofs to DIN 1055

25°	Prevention of Collector Slippage						Prevention of Collector Lifting					
	Weight Per Foot (kg)						Weight Per Foot (kg)					
	10 Tube Collector		20 Tube Collector		30 Tube Collector		10 Tube Collector		20 Tube Collector		30 Tube Collector	
Height Above Ground (m)	A	B	A	B	A	B	A	B	A	B	A	B
8	76	102	76	102	116	155	26	65	26	65	41	100
8 to 20	129	178	129	178	195	269	57	125	51	125	80	191

Stress and maximum load on the substance on flat roofs to DIN 1055

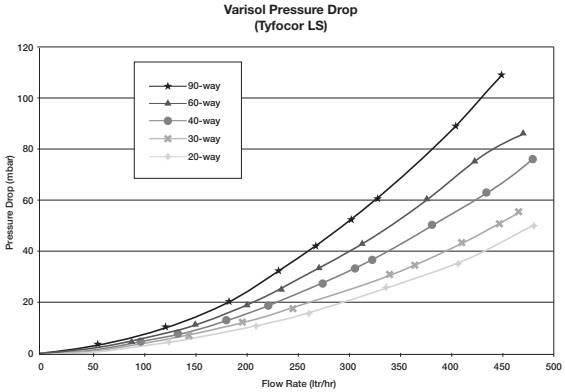
45°	Prevention of Collector Slippage						Prevention of Collector Lifting					
	Weight Per Foot (kg)						Weight Per Foot (kg)					
	10 Tube Collector		20 Tube Collector		30 Tube Collector		10 Tube Collector		20 Tube Collector		30 Tube Collector	
Height Above Ground (m)	A	B	A	B	A	B	A	B	A	B	A	B
8	102	171	102	171	156	256	73	73	73	73	111	111
8 to 20	177	287	177	287	266	430	137	137	137	137	206	206

Technical Specification

Dimensions per tube (Length x Width x Height) [mm]		1950 x 70.9 x 70.9
Weight per tube (kg)		2.2
Volume per tube (l)		0.14
Max. Field Size (m^2)		150 Tubes = 21m^2 (Gross) / 15m^2 (Apperture)
Cu Pipe Diameter (mm)*	1-3m^2	15 x 1
	4-9m^2	22 x 1
	10-15m^2	28 x 1.2
	16-20m^2	35 x 1.5
Max. Operating Pressure (bar)		6
Min. Slope (°)		0
Max. Slope (°)		90
Max. Load (kN/m^2) (DIN 1055-5)		2.5
Heat Transfer Medium		Propylene Glycol suitable for evacuated tube collectors

* Pipe diameters calculated for 0.1l/min/tube and v_max = 0.5m/s

Pressure Drop Curves



Warranty Statement

Kingspan Renewables Ltd
Warranty Statement for Solar

Subject to the following provisions, Kingspan Renewables Ltd warrants that the Goods will be free from defects in material and workmanship for a period of 5 years in relation to KINGSPAN SOLAR PRODUCTS. The warranty is given by Kingspan Renewables Ltd subject to the following conditions:

A. Kingspan Renewables Ltd shall be under no liability in respect of any defect in the Goods arising from any information drawing design or specification supplied by the Buyer
B. Kingspan Renewables Ltd shall be under no liability in respect of any defect arising from fair wear and tear, wilful or accidental damage, negligence, abnormal working conditions, failure to follow the Kingspan Renewables Ltd design and installation instructions, misuse or alteration or repair of the Goods without approval
C. The above warranty does not extend to parts materials equipment not manufactured by Kingspan Renewables Ltd in respect of which the Buyer shall only be entitled to the benefit of any such warranty or guarantee as is given by the manufacturer to the Company.
D. The defect has been reported by the Buyer to Kingspan Renewables Ltd within the warranty period
E. The installation of the Goods having been carried out by fully trained and competent person(s)
F. The Goods having been subjected to neither “prolonged stagnation conditions” nor exhibiting signs of “extreme temperature exposure”

1. The Buyer shall not make any statement or representation or give any warranty to any third party in respect of any Goods other than in the terms made or given by Kingspan Renewables Ltd to the Buyer nor shall the Buyer have any authority to commit Kingspan Renewables Ltd to provide any service in relation to the Goods.
2. The Company’s liability to the Buyer for death or injury resulting from its own or that of its employees’ agents’ or subcontractors’ negligence and damage suffered by the Buyer as a result of any breach of the obligations implied by Section 12 of The Sale of Goods Act 1979 shall not be limited.
3. If Kingspan Renewables fails to deliver the Goods for any reason other than any cause beyond the Company’s reasonable control or the Buyer’s fault then Kingspan Renewables Ltd shall only be liable to the Buyer for and the Company’s liability shall be limited to the excess (if any) of the cost to the Buyer (in the cheapest available market) of similar goods to replace those not delivered over the Price of the Goods.
4. The Buyer shall examine all delivered Goods forthwith. Any claim based on any defect in the quality or condition of the Goods or their failure to correspond with specification shall be notified to Kingspan Renewable Ltd within 7 days from the delivery date or where the defect was not apparent on reasonable inspection within a reasonable time after discovery of the failure. If delivery is not refused and the Buyer does not notify Kingspan Renewable Ltd the Buyer shall not be entitled to reject the Goods.
5. Kingspan Renewables Ltd shall be entitled to examine any Goods, which are the subject of any claim by the Buyer, and to remove such Goods or any part thereof for testing. No tests carried out by the Buyer will be recognised by Kingspan Renewables Ltd unless carried out strictly in accordance with a method previously agreed by Kingspan Renewables Ltd as being suitable for the purpose.
6. Any valid claim in respect of the Goods which is based on any defect in the quality or condition of the Goods or their failure to meet specification is notified to Kingspan Renewables Ltd in accordance with these Conditions Kingspan Renewables Ltd shall be entitled to repair or replace the Goods (or the part in question) free of charge or at the Company’s sole discretion refund to the Buyer the Price (or a proportionate part of the Price) but Kingspan Renewables Ltd shall have no further liability to the Buyer.
7. Kingspan Renewables Ltd shall not be liable to the Buyer by reason of any representation (unless fraudulent) or any implied warranty condition or other term or any duty at common law (including but without limitation the negligence of Kingspan Renewables Ltd its employees agents or otherwise) or under the express terms of the Contract for any loss of production loss of profits or anticipated profits loss of contracts operation time or anticipated savings loss of business or of expected further business loss of or corruption to data damage to the Buyer’s reputation or goodwill damages costs or expenses payable by the Buyer to any third party or any other indirect special or consequential loss or damage or claim (whether caused by the negligence of Kingspan Renewables Ltd its employees agents or otherwise) which arise out of or in connection with the supply of the Goods or their use or resale by the Buyer.
8. Without prejudice to the provisions of clauses 3, 4, 5, 6 and 7 the entire liability of the Buyer under or in connection with the Contract shall not exceed the Price of the Goods.
9. Kingspan Renewables Ltd shall not be liable to the Buyer or be deemed to be in breach of the contract by reason of any delay in performing or any failure to perform any of the Company’s obligations in relation to the Goods if the delay or failure was due to any cause beyond the Company’s reasonable control. Without limiting the foregoing, due to causes beyond the Company’s reasonable control.
10. For comprehensive details regarding “Warranties and Liability” please refer to the “CONDITIONS OF SALES” section 7.

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Due to our continuing policy of development and improvement we reserve the right to alter and amend the specification as shown in this literature.